



**FINAL EXAMINATION
WINTER 2005**

DURATION: 3 HOURS

No. Of Students: 85

Department Name & Course Number: Systems and Computer Engineering

SYSC 4700 Telecommunications Engineering

Course Instructor: D. Falconer

AUTHORIZED MEMORANDA: Non-programmable calculators

This question paper has 15 pages + cover page = 16 pages in all. This examination question paper may not be taken from the examination room.

Instructions:

- (1) DO QUESTION 1 PLUS ANY FIVE OF THE REMAINING NINE QUESTIONS.** All questions carry equal weight. If more than a total of 6 questions are attempted, indicate which 6 you wish to be marked. Otherwise, only the first 6 will be marked (including question 1).
- (2) Read the questions carefully, and state any assumptions necessary. Write your answers clearly, using the spaces provided on the examination paper. If necessary, you may use the reverse (blank) side of any page, or the blank pages at the end, to write answers or do rough work. Questions may be answered in point form, or in short essay form.**

There are 4 blank pages at the end.

	Question	Mark	Out of
<u>Do question1</u>	1		12
<u>Do only 5 out of Questions 2-10</u>	2		12
	3		12
	4		12
	5		12
	6		12
	7		12
	8		12
	9		12
	10		12
	Total		72

YOUR NAME: _____

(Please underline your family name)

STUDENT NUMBER: _____

Question 1

Describe the purpose and operation of any four of the following:

- (a) Connection-oriented and connectionless packet switching modes.
- (b) Add-drop multiplexer in a SONET system
- (c) A slip buffer in a plesiochronous-synchronized system.
- (d) Concentration in pair gain or digital circuit switching systems.
- (e) Statistical multiplexing
- (f) Digital space switching

Question 1 (cont.)

DO ONLY FIVE OF QUESTIONS 2 TO 10:

Question 2

- (a) Describe how the public telephone system handles a call from a subscriber to a 1-800 (toll-free) number.
- (b) Describe how redundancy is used to protect the CCS7 signalling system against link failures.

Question 3

Estimate (i.e. guess, without using formulas or tables, or computing anything) the approximate number of channels (lines or trunks or channels) needed to serve each of the following traffic situations, for a blocking probability of about 0.01. Using your knowledge of the principles of traffic theory, explain your reasoning in making each estimate.

- (a) a single subscriber, with 0.1 Erlang traffic intensity
- (b) 10 subscribers, each with 0.1 Erlang traffic intensity.
- (c) 1000 subscribers, each with 0.1 Erlang traffic intensity.
- (d) The above cases are for voice telephony. How would you expect the answers to change if each subscriber has digital subscriber loop service for a high speed internet connection?

Question 4

- (a) Describe the advantages of using rings (e.g. SONET rings) in networks.
- (b) Describe how a SONET unidirectional ring deals with a fiber cut in the ring. Show a diagram to illustrate your answer.

Question 5

Describe the following aspects of cellular radio systems:

- (a) how the network (mobile serving office, cells, base stations, subscriber cell phones) is arranged to allow calls to and from subscribers.
- (b) how frequency channels are efficiently used.
- (c) how calls are routed to and from subscribers
- (d) how the network handles movement of subscribers from one cell to another.

Question 6

Describe and compare the following high speed digital subscriber access technologies:

(i) DSL (digital subscriber line)

(ii) PON (passive optical network),

as follows:

- (a) Their technologies (what they consist of and how they work)
- (b) Their relative costs of installation and operation.
- (c) Their abilities to deliver high bit rates to and from subscribers.

Question 7

- (a) List the functions of UDP and TCP protocols, and discuss their similarities and differences.
- (b) Discuss the purpose and operation of IP address summarization.

Question 8

- (a) Describe the main functions of a telecommunications regulator, such as CRTC.
- (b) Describe the main functions of federal telecommunications policy-making.

Question 9

- (a) Compare, by discussing their advantages and disadvantages, symmetric key and asymmetric (public key cryptography) systems.
- (b) Using an example, describe how a message is encrypted and decrypted for confidentiality in a public key cryptography system.
- (c) Extend this example to show how the sender's identity can be verified by the recipient of the message.

Question 10

Describe each of the following components of network management, and why each is important:

- (a) service assurance and fault management
- (b) provisioning
- (c) performance management
- (d) change management

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